

## PATENT COOPERATION TREATY


## PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT  
(PCT Article 36 and Rule 70)

REC'D 28 JUN 2004

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Applicant's or agent's file reference 022569wo HPJ/ko	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP 02/11626	International filing date (day/month/year) 17.10.2002	Priority date (day/month/year) 03.06.2002
International Patent Classification (IPC) or both national classification and IPC B22C9/08		
Applicant CARBON APPLICATION TECHNOLOGY LTD. et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 2 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>		
Date of submission of the demand  01.04.2003	Date of completion of this report  25.06.2004	
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Sembritzki, T  Telephone No. +49 89 2399-8626	



**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. PCT/EP 02/11626

**I. Basis of the report**

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

**Description, Pages**

1-16 as originally filed

**Claims, Numbers**

1-11 received on 06.08.2003 with letter of 06.08.2003

**Drawings, Sheets**

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Yes: Claims	1-11
	No: Claims	
Inventive step (IS)	Yes: Claims	1-11
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-11
	No: Claims	

2. Citations and explanations

**see separate sheet**

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Reference is made to the following documents:

D3: US-A-5 785 851 (MORRIS JAY M ET AL) 28 July 1998 (1998-07-28)

D4: WO 01/40414 A (TOUCHSTONE RES LAB LTD) 7 June 2001 (2001-06-07)

**Item V:**

**1. Novelty**

- 1.1 Document D3, which is considered to represent the closest prior art, discloses a reticulated ceramic filter for the filtration of molten steel. The filter comprises a plurality of filter screens in series relation having a corrugated surface (see D3, abstract and figures 1-10).

The subject-matter of claim 1 of the present application differs from D3 in that the filter has a bonded network of graphitized carbon and in that the two sieve plates are joined to each other at a protruding frame so that a space or reservoir chamber is formed. Accordingly, the subject-matter of claim 1 is novel, the same applies to the subject-matter of corresponding method claim 8 (Article 33(2) PCT).

**2. Inventive step**

- 2.1 Ceramic filter tend to be clogged by freezing particles when the molten metal comes in contact with the surface of the filter element. To overcome this problem it has been tried to use carbon coatings in order to reduce the thermal mass of part of the filter which comes in direct contact with the molten metal. This additional coating is expensive and requires additional process steps.

Furthermore, this coating does not solve the additional problems, that ceramic or glassy type bonds tend to soften and creep at high temperatures and that such ceramic filters tend to crack due to thermal shock or chemical corrosion.

The above problems are overcome by the use of a network of graphitized carbon in a filter which comprises a space or reservoir chamber formed by joining two sieve plates at their protruding frames.

The use of graphitized carbon in a filter for molten metal has been disclosed in document D4 (see D4, page 10, line 21-page 12, line 21), however, the carbon foam material is on the one hand not suitable for the filtration of molten steel, on the other hand document D4 is silent about the special form of the filter. Thus, a skilled person would not take into account the disclosure of D4 if he has to solve a problem regarding the filtration of molten steel and, furthermore, a combination of both documents would not lead to the combination of features defined in present

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independent claims 1 and 8. The subject-matter of the aforementioned claims is therefore regarded as involving an inventive step (Article 33(3) PCT).

2.2 Claims 2-7 and 9-11 are dependent on claims 1 and 8 and as such also meet the requirements of the PCT with respect to novelty and inventive step.

**3. Industrial application**

The industrial applicability is obvious.

**4. Remarks**

4.1 The wording "..are incorporated by reference.." (see page 8) should be removed (Rule 9(1iv) PCT).

4.2 The application number 01121044.0 of the co-pending patent application (see page 8, line 5) corresponds to the publication number EP 1 288 178 A1. This document is an intermediate document claiming an older priority and could become relevant in the regional phase.

4.3 The description of the present application is not adapted to the new claims (Article 6 PCT).

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HPJ/ko

09 December 2003

Carbon Application ..

## Claims:

1. Filter device (1) for molten steel filtration **having a bonded network of graphitized carbon**, containing at least two sieve plates (2,4), **each having a corrugated surface (6,6a) (peaks and trough) and a protruding frame (5,5a) joined to each other at the protruding frame by forming a space or reservoir chamber.**
2. Device (1) according to claim 1, characterized in that at least one of the surfaces (6,6a) of said sieve plates (2,4) facing together has a surface corrugation in the range of 0.1 mm to 10 mm, in particular 1 mm to 5 mm.
3. Device (1) according to claim 1 or 2, characterized that the through holes (3,3a) of the respective sieves plates (2,4) are spaced laterally to each other.
4. Device (1) according to one of claims 1 to 3, characterized in that the diameter of the through holes (3,3a) of the respective sieve plates (2,4) is in the range of 1 to 10 mm, in particular 2 to 5 mm.
5. Device (1) according to one of claims 1 to 4, characterized in that the geometry of the through holes (3,3a) of said sieve plates (2,4) is circular, elliptical, triangular, square, rectangular, pentagonal or hexagonal.
6. Device (1) according to one of claims 1 to 5, characterized in that the geometry of each of the sieve plates (2,4) is identical.
7. Device (1) according to one of claims 1 to 6, characterized in that the filter is made of ceramic raw material, in particular made of ceramic material comprising a network of graphitized carbon and optionally reinforcing fibers.
8. A method to produce a filter device (1) according to one of claims 1 to 7 comprising the steps

- a) pressing a semi-damp mixture comprising ceramic powder and a graphitizable bonding precursor, fibers and other additives in a hydraulic press to obtain a first and second perforated sieve plate (2,4) in the shape of a disk with a protruding frame (5,5a), with a corrugated surface (6,6a) (peaks and trough) of at least one of the inside surfaces (6,6a) of the sieve plate (2,4) ,
- b) joining said two sieve plates (2,4) to each other by the protruding frame (5,5a) using a ceramic or carbon binder so that a space or reservoir chamber (7) is formed between the two plates (2,4) and
- c) firing the assembled filter device (1) in reducing or non-oxidizing atmosphere to a temperature up to 1000 °C , preferably between 600 °C and 700 °C.

9. The method according claim 8 characterized in that the surface (6,6a) is roughened in a further step prior or after the firing of the sieve plate (2,4).

10. The method according to claim 8 or 9 characterized in that said semi-damp mixture contains a graphitizable carbon bonding precursor, ceramic powder, and other additives.

11. The method according anyone of claims 8 to 10, characterized in that said precursor is fired at a temperature in the range of 500 to 2000 °C, in particular 500 to 1000 °C.